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OF OUTER SPACE

REPORT OF THE UNITED NATIONS EXPERT ON SPACE APPLICATIONS TO THE SCIENTIFIC AND TECHNICAL SUB-COMMITTEE

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INTRODUCTION

1. At its twenty-seventh session, held in New York from 26 February to 9 March 1990, the Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space reviewed the activities of the United Nations Programme on Space Applications (hereafter referred to as "the Programme"). The Sub-Committee noted that the activities of the Programme for 1989 had been carried out satisfactorily and that the activities scheduled for 1990 had been endorsed by the General Assembly in its resolution 44/46 of 8 December 1989. The Sub-Committee recommended to the Committee on the Peaceful Uses of Outer Space, for its approval, the activities scheduled for 1991 under the regular budget and took note of other Programme activities, all of which are to be implemented as part of the space-applications-related recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82), as proposed by the Expert on Space Applications in his annual report (A/AC.105/446) submitted to the Scientific and Technical Sub-Committee at its 1990 session.

I. MANDATE OF THE PROGRAMME

2. The United Nations Programme on Space Applications operates within the scope of its expanded mandate as contained in General Assembly resolution 37/90 of 10 December 1982, taking into account the recommendations of UNISPACE 82, with special emphasis on the following activities: (a) provision of long-range fellowships for in-depth training; (b) provision of technical advisory services to Member States and regional institutions upon request; (c) organization of a series of regional and international training courses, seminars, workshops and technical expert meetings for the benefit of specialists, educators, managers and decision-makers in order to enhance their technical capabilities as well as to keep them abreast of ongoing developments in the discipline; (d) provision of assistance in the development of indigenous capability at the local level; (e) acquisition and dissemination of space-related information; and (f) promotion of greater co-operation between developed and developing countries, as well as among developing countries. Presented below is a summary of the activities carried out in 1990, including those scheduled for implementation in 1991 and those proposed for 1992.

3. In its resolution 44/45, in endorsing the recommendation of the Committee regarding the participation of the United Nations in International Space Year, the General Assembly also directed that "the training and educational capabilities of the United Nations Programme on Space Applications should be utilized to bring about a meaningful role for the United Nations". The efforts of the Programme in this regard are identified in chapter V of the present report and are fully described in document A/AC.105/445/Add.3; a summary of that document appears in paragraphs 58 to 61 of the present report.

READEX FICHE

A. Long-range fellowship programmes for in-depth training

4. The Programme received 39 long-term fellowship offers for the 1990/91 period from the Governments of Austria (2), Brazil (10), China (2) and the Union of Soviet Socialist Republics (21), as well as from the European Space Agency (ESA) (4); all of these fellowships have been renewed for the 1991/92 period. The status of the 1990/91 awards and the recipients' countries are set out in annex I to the present report. Details of the offers are presented below.

5. The Government of Austria renewed its annual offer of two fellowships for in-depth training in microwave technology, each for a period of one year. The 1990/91 fellowship offers, already awarded and accepted, are for the period 1 October 1990 to 30 September 1991; these awards are tenable at the Technical University Graz, Graz, Austria.

6. The long-term fellowships offered by the Government of Brazil are for research and applications in remote sensing technology and are tenable at the Instituto Nacional de Pesquisas Espaciais (INPE), São José dos Campos, State of São Paulo, Brazil. The fourth set of participants in this fellowship series, selected from the Economic Commission for Latin America and the Caribbean (ECLAC) region, completed their nine months of training at INPE on 30 November 1990. The next set of participants will be selected from among candidates from English-speaking countries of the Economic Commission for Africa (ECA) and ECLAC regions and will undergo their training at INPE from 14 March to 14 November 1991.

7. The Government of China has established two new fellowships, each for a period of one year, for research and training in geodesy, photogrammetry and remote sensing. This fellowship programme is being offered to university graduates with the objective of contributing to the development of indigenous capability in developing countries. Two recipients (from Jordan and Zaire) of the 1990/91 awards are now in residence at Wuhai Technical University of Surveying and Mapping, Wuhai, China.

8. The Government of the Union of Soviet Socialist Republics renewed its annual offer of 15 fellowships for studies in geodesy, cartography and aerial photography. As indicated in the 1989 annual report of the Space Expert (A/AC.105/446), a reorientation of this programme was discussed and agreed to in 1990. Accordingly, five (5) of these fellowships, each for a period of three years, are being offered to university graduates. A successful completion of the post-graduate programme will lead to the award of a Ph.D. degree in engineering sciences. The remaining 10 fellowships, each for a period of five years, with an additional year for the study of the Russian language, are still tenable for graduates from high schools; the completion of this aspect of the programme will lead to the award of a Master's degree in engineering sciences. The seven recipients of the 1990 awards are now in residence at the Moscow Engineering Institute of Geodesy, Cartography and Aerial Photography.

9. The Government of the USSR has also renewed its offer of six research fellowships in four fields of space science and technology, each for a duration of three years. The fellowships are tenable at the institutes of the Academy of Sciences of the USSR and are being offered for interns and post-graduate students from developing countries. The six fellowships are for studies in the following specific disciplines: (a) S. P. Korolev fellowship awards (two) for studies in scientific instrument manufacturing; (b) Ya. B. Zeldovich fellowship awards (two) for studies in theoretical and experimental astrophysics; (c) M. V. Keldysh fellowship award (one) for studies in systems and methods of space information processing; and (d) K. E. Tsiolkovskii fellowship award (one) for studies of the Earth's rotation and lithosphere plate movement using space technology. Four fellows began their studies within this programme in February 1990.

10. The Government of the USSR has also established five new fellowships, each for a period of up to four years, for research, training and post-graduate education leading to an M.Sc. or a Ph.D. degree in the following disciplines: (i) optical-electronic instruments for remote sensing; and (ii) monitoring of the Earth's resources and its environment. The fellowships are tenable at the Scientific and Research Centre operated jointly by the People's Friendship University and the Scientific and Research Institute for Space Instrumentation in Moscow. This new programme is being offered to post-graduate students and specialists from developing countries; the fellowship programme aims at promoting the use of the achievements in space technology for social and economic development in developing countries.

11. ESA renewed its offer of four fellowships, each for a period of one year, for the 1990/91 period; the fields of study and ESA's institutions where the fellowships are tenable are as follows:

(a) Space antennae and propagation: European Space Research and Technology Centre, Noordwijk, the Netherlands, from 1 October 1990 to 30 September 1991;

(b) Remote sensing information systems: European Space Research Institute, Frascati, Italy, from 1 January to 30 June 1991; two individuals participating simultaneously for a period of six months each;

(c) Satellite Meteorology: European Space Operations Centre, Darmstadt, Germany, from 15 October 1990 to 30 September 1991;

(d) Communications systems: European Space Research and Technology Centre, Noordwijk, the Netherlands, from 15 October 1990 to 30 September 1991.

B. Technical advisory services

Costa Rica Space Conference

12. At the request of the Government of Costa Rica, the Programme assisted in the organization of the Space Conference of the Americas: Prospects of Co-operation for Development, held from 12 to 16 March 1990 at San José. The objective of the Conference was to identify specific space science and technology projects in which ECLAC Member States and their institutions could participate, at the subregional, regional or international level. The Conference was attended at both political and scientific levels by representatives of 22 countries from North, Central and South America and the Caribbean as well as by representatives from a number of national and regional space agencies, the United Nations and its specialized agencies and observers from European and Asian countries and international professional and scientific organizations.

13. The Conference was conducted through both plenary meetings at the governmental level and working group meetings organized through five parallel sessions. The participants addressed the technical issues of regional and international co-operation in the areas of basic space sciences, space applications, space technology, education and legal matters. At the conclusion of the Conference, the delegates agreed that the Ministry of Science and Technology of Costa Rica should develop specific project proposals and should explore the possibilities of co-operation for their implementation among Member States in each of the five areas identified above. Such proposals are to be circulated to the countries of the region for their review and comments and for possible identification of the projects in which they wish to participate. Support for the implementation of these projects would be sought from regional and international funding institutions as well as from Governments, space agencies and other organizations that would be invited to participate in their execution. A full report of the Conference has been prepared and is being distributed by the Ministry of Science and Technology of Costa Rica.

UN/ESA Project in Africa

14. As a follow-up to the United Nations/United Nations Development Programme (UNDP)/Food and Agriculture Organization of the United Nations (FAO)/ESA Meeting of Experts on Remote Sensing and Satellite Meteorology Applications to Marine Resources and Coastal Management in the Atlantic Coast of Africa Region (A/AC.105/436, paras. 9-27), and the United Nations, through its Space Applications Programme, have conducted a survey leading to the selection of specific sites in those African countries that are within the perimeter of ESA's Fucino and Maspalomas ground receiving stations. The aim of the project is to make available historical, current and future data from different satellites so that they may be used to support development programmes in different application projects, particularly irrigation, roads, water resources and agriculture in those African countries. ESA is providing the financial support for this activity.

Indian Ocean

15. The Outer Space Affairs Division continues to offer technical advisory services to the Indian Ocean Marine Affairs Co-operation (IOMAC) in connection with the organization of pilot projects to study the use of remote sensing for mapping, monitoring and managing coastal resources. The Government of France has offered the services of its technical experts to assist in the project.

Regional Centre at Nairobi

16. The Programme assisted the Economic Commission for Africa and the Governing Council of the Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS) to carry out a fact-finding mission at the Centre. The mission assessed the administrative and technical capabilities of the Centre to provide adequate services to support the programmes and projects within its mandate, reviewed its plans for the future, evaluated the Centre's expertise with a view to determining whether the needs of Member States could be met through such expertise and assessed the overall performance of the Centre. The mission recommended (a) a number of steps that could be taken to meet the needs of Member States and (b) needed resources to strengthen the technical departments of the Centre. The report of the mission, which has been submitted to ECA, has been transmitted to all the Member States that are served by RCSSMRS and to all the members of its Governing Council for their study. The adoption of the recommendations contained in the report should enhance the integrity of the Centre, ensure its long-term survival and lead to its sustained productive contribution to the development of eastern and southern Africa.

Ground receiving station at Cotopaxi, Ecuador

17. The Programme will assist the Centro de Levantamientos Integrados de Recursos Naturales por Sensores Remotos (CLIRSEN) of Ecuador to undertake a survey of the Member States that are within the perimeter of its Cotopaxi Remote Sensing Ground Receiving Station in order to fully provide essential information on the importance of the station and its services and products to their social and economic development. The conclusion of the survey will be followed by a mission to a few selected countries in the region in order to ensure the full utilization of the services of the station and adequate support from those that could benefit from its services.

C. United Nations training courses/workshops

1. Activities carried out in 1990

18. In 1990, the United Nations conducted one training course and two workshops under the auspices of the Programme. In addition, the Programme financially supported and co-sponsored a United Nations/FAO/ESA International Workshop on Remote Sensing: Geo-information Technology for Decision Makers, organized in co-operation with the Government of France and held at Rome from 7 to 16 November 1990. The Programme also financially supported and co-sponsored a

United Nations/FAO International Training Course on Agriculture Applications of Remote Sensing, held at Prague from 18 to 29 June 1990.

19. The support of Member States and their institutions as well as those of regional and international organizations was instrumental in the successful implementation of these activities; such support included voluntary contributions, both in money and in kind, and technical and scientific presentations by their experts. A summary of each of these activities is presented below.

Stockholm and Kiruna Training Course for Educators

20. The United Nations International Training Course on Remote Sensing Education for Educators was organized in co-operation with the Government of Sweden through the Swedish Agency for International Technical and Economic Co-operation (BITS); it was hosted by the University of Stockholm and the Swedish Space Corporation (SSC) for the benefit of Member States in the ECA region. The course was held at Stockholm and Kiruna from 14 May to 15 June 1990. Twenty-five educators from African universities and colleges participated.

21. The main objective of the course was to develop practical knowledge and skills of educators from African States in remote sensing technology; it also aimed at equipping them with the ability to introduce elements of the technology, as appropriate, in the education curricula in their universities and institutions. The programme of the course was designed to provide participants with a basic understanding of the development and use of remote sensing technology in natural resource management and environmental planning and to expose them to the process of introducing the discipline into the educational programmes in their own countries.

22. The programme was designed jointly by the United Nations Outer Space Affairs Division, the University of Stockholm and SSC. The United Nations was responsible for the overall external organizational arrangements and the Government of Sweden, through Stockholm University, SSC and BITS, co-ordinated local arrangements and provided professional services of instructors, technical equipment, materials, course facilities and local transportation. Funds allocated by the United Nations were used to defray the costs of international air travel for 13 participants and 2 lecturers invited from abroad, as well as for daily subsistence for the lecturers. The Government of Sweden provided room and board, local transportation and pocket money for all the participants as well as international air travel for 10 participants. Norway funded the participation of one instructor. The report on the training course is contained in document A/AC.105/463.

Havana Communications Workshop

23. The United Nations Workshop on Space Communications for Development, organized in co-operation with the Government of Cuba, was held at Havana from 16 to 30 March 1990. The Workshop, organized for the benefit of Member States of the ECLAC region, was hosted by the Ministry of Communications and the Academy of Sciences of Cuba. The objective of the workshop was to provide an opportunity for the exchange of information on the technical and operational issues associated with various international and regional satellite communications systems and services.

The workshop reviewed the status and projected directions of space and land (fibre optics/microwave repeaters) communications technology and the advances in related computer hardware and software. While noting that the trends of decreasing prices and increasing capabilities of all areas of communications/computer technologies will continue, the workshop emphasized the advantages of space communications applications to rural communications. In particular, the observations and recommendations of the workshop focused on satellite applications to rural education, rural medicine, support for rural hospitals, doctors and paramedical personnel and to disaster relief operations.

24. The workshop was attended by 57 participants from 13 countries from the ECLAC region, 6 industrialized countries and 8 regional and international organizations. Funds allocated by the United Nations were used to defray the cost of international air travel and a daily subsistence allowance for board and incidental expenses for 15 participants. The Government of Cuba provided hotel accommodations for 14 participants from developing countries, conference facilities and local transportation. Canada and Spain funded the participation of two experts each; one expert was funded by each of the following: France, Italy, USSR, the International Maritime Organization (IMO), the International Maritime Satellite Organization (INMARSAT), the International Telecommunications Satellite Organization (INTELSAT), the International Organization of Space Communications (INTERSPUTNIK) the International Telecommunication Union (ITU) and the United Nations Disaster Relief Organization (UNDRO). A detailed report on the workshop is contained in document A/AC.105/469.

Sao José dos Campos (Brazil) Microwave Workshop

25. The United Nations/FAO/ESA Workshop on Microwave Remote Sensing Technology, organized in co-operation with the Government of Brazil, was held at Sao José dos Campos, Brazil, from 19 to 23 November 1990. The workshop was organized for the benefit of participants from the ECLAC region and was hosted by the Instituto Nacional de Pesquisas Espaciais. The objective of the workshop was to expose the participants to various aspects of current and future microwave remote sensing systems, including the acquisition, processing, archiving and applications of the data generated by such systems. The presentations at the workshop provided an overview of microwave remote sensing, of the physical principles of image formation and of the interpretation and analysis of the elements involved in the applications of the technology to tropical forest environments, agriculture, hydrology and oceanography. The experiences and programmes of a number of countries in the use of microwave remote sensing, including those of some of the Latin American countries, were also presented. The workshop concluded with working group deliberations focused on three major areas: data accessibility and availability, education and applications development. The workshop noted that since there will be a continuous supply of microwave data for at least the next 10 years, the ECLAC region should establish mechanisms, through Sociedad de Especialistas Latinoamericanos en Percepción Remota (SELPER), for achieving common data formats, adequate education programmes and possible solutions to the needs and requirements of the region in the application of the technology.

26. The workshop was attended by 57 participants from 11 developing countries of the ECLAC region and six national and international organizations possessing expertise in microwave remote sensing. Funds allocated by the United Nations, FAO and ESA were used to defray the cost of international air travel and per diem to cover room, board and incidental expenses of 19 participants. In addition to the speakers funded by the co-sponsors of the workshop, the Government of Canada and INTERA Technologies of Canada funded the participation of one expert each. The Government of Brazil provided the conference facilities and local transportation for all participants. A detailed report on the workshop is contained in document A/AC.105/471.

Prague Remote Sensing Training Course

27. A United Nations/FAO International Training Course on Agricultural Applications of Remote Sensing was hosted by the Agricultural University of Prague, at Prague, from 18 to 29 June 1990. The course was organized to provide training on remote sensing techniques that are appropriate for agricultural applications. The course programme included lectures, presentations of case studies, discussions and three days of practical field exercises. It was attended by 39 participants from 22 countries of Africa, Asia, Europe and Latin America.

28. The course participants noted that the importance of agricultural applications of remote sensing is rapidly increasing because of the necessity to improve information on agricultural land use, especially in areas threatened by land degradation. Consequently, the participants recommended that a course of this type should be organized annually and should be supplemented by other courses at the regional level. While the programme of the course was well structured, participants felt that more time should have been allocated to discussions. It was also felt that the number of participants should have been reduced to about 20 and that PC-based digital image analysis systems should be made available to each group of three to four participants at such a course. The course papers will be published as a proceeding by FAO.

Rome Workshop for Decision Makers

29. The United Nations/FAO/ESA/Government of France International Workshop on Remote Sensing: Geo-information Technology for Decision Makers, was hosted by FAO in Rome from 7 to 16 November 1990. The objectives of the workshop were to provide the participants with an understanding of the general model of geo-information production and to analyse the technical feasibility of using remote sensing in relation to discipline-related and departmental tasks and needs. Elements of the workshop included presentations of case studies and one day of practical field exercises.

30. The programme of the workshop addressed the management of renewable natural resources; management of remote sensing and geo-information systems at global and national levels and future outlook; agricultural applications of remote sensing; forestry applications of remote sensing; applications of remote sensing and geo-information systems to water resources and watershed management; applications of remote sensing and geo-information systems to marine and inland fisheries; and

the organization and management of remote sensing units. The workshop was conducted by means of illustrated lectures, tutorials and a field trip.

31. Participation in the workshop was restricted to decision makers in order to fill the gap in remote sensing technology transfer efforts, which have consistently focused on the training of technicians. All participants stressed the importance of alerting decision makers in their countries on remote sensing and Geographic Information System (GIS) technologies with emphasis on operational applications, cost/benefits analysis, institutional infrastructures at the regional, national and sectoral levels and project design. They requested the continuation of the workshop on an annual basis and efficient follow-up contacts with the workshop participants.

32. Twenty participants from 19 developing countries took part in the workshop. Funds allocated by the United Nations, FAO, ESA and the Government of France were used to defray the cost of international air travel and subsistence expenses in Rome for the duration of the course for the 20 participants. The workshop presentations will be published as a proceeding by FAO.

2. Activities scheduled for implementation in 1991

33. The following training courses and workshops are scheduled for 1991:

(a) A United Nations/ESA Workshop on Basic Space Research is to be organized in co-operation with the Government of India for the benefit of developing countries, particularly those in the Economic and Social Commission for Asia and the Pacific (ESCAP) and the Economic and Social Commission for Western Asia (ESCWA) regions. The workshop will be hosted on behalf of the Government of India by the Indian Space Research Organization (ISRO) and will be held at its headquarters at Bangalore from 30 April to 4 May 1991. The workshop is being organized in recognition of the fact that scientific, economic and social developments and progress of countries are strongly interwoven and that basic space science, including the physical and mathematical sciences, plays an important role in providing locally derived solutions to problems of development in general. The objective of the workshop is to improve the awareness of scientists from developing countries of the importance of basic space research and to the immediate applications that could be generated on the basis of such a knowledge to effect a greater impact in the development of their respective countries;

(b) The third United Nations/ESA Workshop on Microwave Remote Sensing Technology, co-sponsored by FAO, is to be organized in co-operation with the Government of Spain for the benefit of ECA and ESCWA member States; it will be hosted by the National Institute for Aerospace Technology (INTA)-Maspalomas Station from 10 to 14 June 1991. The objective of the workshop is to provide participants with information relating to a number of microwave remote sensing satellites that are being planned for launch in the next few years and to discuss how developing countries can individually and collectively prepare to use the information that will be provided by these new systems for the development and management of their natural resources;

(c) The fifteenth United Nations/FAO International Training Course: Remote Sensing Applications to Renewable Resources will be organized in co-operation with the Government of Italy, and held at FAO headquarters, Rome, in September 1991. The course will provide training in the interpretation of satellite and aircraft remote sensing data for the development and management of renewable resources;

(d) The United Nations will organize a 30-day international training course on remote sensing applications for environmental assessment and monitoring, in co-operation with the Government of the United States of America, to be held at the EROS Data Center, Sioux Falls, South Dakota, from 9 September to 4 October 1991. The training course, which is one of the contributions of the United States to the participation of the United Nations in International Space Year (ISY), will focus on the multidisciplinary use of global data sets, including remotely sensed data, for global change study and resources management. The course will consist of lectures, practical workshop exercises and demonstrations of processing techniques and methods for the applications of environmental data. Emphasis will be placed on data capture, data characteristics, data-base development, analysis techniques, modelling, assessment of results and output product generation. The course will be organized for 30 international participants;

(e) A United Nations/FAO/ECA Regional Seminar on Remote Sensing for Decision-Makers, will be organized at the Regional Centre for Services in Surveying Mapping and Remote Sensing (RCSSMRS) at Nairobi from 17 to 21 June 1991, for the benefit of Member States in the ECA region. The purpose of the seminar is to provide decision makers with a basic knowledge of remote sensing technology and its utility in the management of natural resources and the environment in Africa;

(f) A United Nations Regional Workshop on the Application of Space Techniques to Combat Natural Disasters, co-sponsored by UNDRO, WMO and the United Nations Educational, Scientific and Cultural Organization (UNESCO), will be organized in co-operation with the Government of China and ESCAP. It will be hosted by the State Science and Technology Commission of China and will be held in Beijing from 16 to 20 September 1991 for the benefit of developing countries, particularly those within the ESCAP region. Participating at the workshop will be individuals with responsibilities for disaster prevention and relief in their respective countries. This workshop is the contribution of China to the activities undertaken by the United Nations as part of ISY;

(g) The seventh United Nations/FAO/WMO/ESA Training Course on the Applications of Remote Sensing in Agrometeorological and Hydrological Studies will be organized for the benefit of Member States in the ECLAC region from 7 to 25 October 1991. The training course will provide participants with practical knowledge on the type and use of data obtained in the visible, infrared and microwave regions of the electromagnetic spectrum, particularly for hydrological and agrometeorological applications. The course will also provide participants with information on the characteristics of the data from current and future satellite systems.

3. Activities proposed for implementation in 1992

34. The following training courses, seminars and conferences are proposed for 1992:

(a) United Nations/United States International Conference on Satellite Remote Sensing for Resource Management, Environmental Assessment and Global Change Studies: Needs and Applications in the Developing World, Washington;

(b) Seventh United Nations/FAO/WMO/ESA Training Course on the Applications of Remote Sensing in Agrometeorological and Hydrological Studies, Nairobi;

(c) Second United Nations/Sweden Training Course on Remote Sensing Education for Educators, Stockholm and Kiruna, Sweden;

(d) International Seminar on Satellite Communications, organized in co-operation with the Government of the USSR, Moscow;

(e) United Nations/FAO/International Centre for Theoretical Physics (ICTP) Training Course on Remote Sensing Applications, Rome;

(f) United Nations Regional Communications Workshop, organized in co-operation with the Government of China, for the benefit of ESCAP member States;

(g) Second Space Conference of the Americas (a follow-up to the Space Conference of the Americas held in Costa Rica, March 1990);

(h) United Nations/UNESCO/WMO/ICTP Conference on "Bridging the Information Gap in Space Science and Technology", to be held at United Nations Headquarters.

D. Development of indigenous capability

35. Remote sensing technology has become operational and is being applied to improve the knowledge of the natural resources of many nations, to provide information necessary for the rational exploitation of those resources and to assist in preventing or redressing damage to the Earth's environment. Indeed, it is being amply and continuously demonstrated, through a variety of projects, that remote sensing can contribute significantly to the achievement of the economic and social development goals of nations. Environmental and natural resources data of different parts of the world are being observed daily by an array of Earth-orbiting satellites and manned space vehicles. These activities will be intensified with the passage of time. For a long time to come, space-borne sensors may be the only source of reliable data on the environment and natural resources of most developing countries. The availability of such data can assist these countries to better understand and safeguard their environment as well as to ensure a more efficient management and productive harnessing of their natural resources.

36. However, in order for the developing countries to share in the benefits inherent in remote sensing technology and to employ this technology gainfully to safeguard the environment, there must be an adequate and long-term investment in the development of skills and knowledge in the discipline at the local level.

37. At its forty-fifth session, in its resolution 45/72 of 11 December 1990, the General Assembly, in recognition of the above situation, endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that:

> "... the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish regional centres for space science and technology education in existing national/regional educational institutions in the developing countries".

38. The Outer Space Affairs Division has developed a project document (SAP/90/001-004) which is to serve as the instrument for the establishment of the aforementioned regional centres for space science and technology education in developing countries. Funding for the establishment of the centres will be solicited from Member States as well as from UNDP and other regional and international funding institutions.

39. The centre in each region will be housed in a major science-and-technology-oriented university or a space research institution with an ongoing education programme. Such an arrangement will enable the centre to utilize optimally the existing professional staff and physical infrastructure at the host institution. During its initial four-year period, the centre's programme will focus on remote sensing technology and its application to the various disciplines. By providing appropriate instruction to the educators of institutions of higher learning on a long-term basis (nine-month period), the centre will achieve the integration of remote sensing and related technologies into existing educational curricula in the physical, natural and environmental sciences in the universities and colleges in the developing countries and through this process will strengthen the education programmes in those institutions.

40. The centre will also provide research and development support for national and regional remote sensing user assistance and training centres. It will complement as well as strengthen the capabilities of these centres. On request, the centre will also provide consultancy services in remote sensing research and applications to Member States.

41. Through the above efforts, the establishment of the centres should result in many multiplying effects and thereby:

(i) Contribute significantly to indigenous capability development in remote sensing, including satellite meteorology and environmental disciplines in each participating country;

(ii) Enhance scientific and technical education in each participating country and region;

(iii) Enhance the quality and quantity of contributions of graduates towards the overall development of their respective nations and towards the management of the resources and the environment of their countries;

(iv) Strengthen the capabilities of institutions of higher learning and national and regional remote sensing user assistance and training centres;

(v) Assist user agencies in Member States to strengthen their capabilities in the use of remote sensing for the management of the natural resources and environment of those countries.

42. The curriculum of each of the centres will address environmental and resource development and management problems and thus equip the participating educators to solve similar problems in their own countries. Through this process those educators will readily be able to appreciate the significance of their being part of the solution to the problems that confront their respective societies and will be better equipped to provide their students with the requisite knowledge in those disciplines.

43. In order to achieve these objectives, the establishment of each centre is designed to be implemented in four phases. Phase 1 includes the preparatory activities for the establishment of the centre; these include identification and negotiation with the host Government and the host institution and the selection of project personnel and consultants. Phase 2 includes the inventory of scientific and technical education materials, the hiring of experts and the acquisition of the necessary equipment and materials, the installation of equipment and laboratory facilities and the training of support personnel in the use and maintenance of equipment and facilities. Phase 3 is the operational phase of the centre and will focus on the organization and implementation of the programme for the training of natural, physical and environmental science educators and the organization of workshops for secondary and primary school teachers. Phase 4, which will overlap with phase 3, will be devoted to the implementation of pilot projects through which each participating educator will introduce the acquired knowledge into his/her teaching and research activities at home. Evaluation workshops will also be conducted during this phase in order to assess the impact of each centre's activities.

44. Each of the centres is to be managed by a governing council made up of representatives of the host country, each of the sponsors, the centre itself and the executing agency. The regional economic commissions of the United Nations are playing leading roles in the establishment of these centres. Details of the various aspects of each of the centres are contained in documents SAP/90/001-004. These documents and the appeal of the United Nations for financial support for the establishment of the centres have been forwarded to all Member States.

E. Information systems

45. The directory on "Education, Training, Research and Fellowship Opportunities in Space Science and Technology and its Applications" (A/AC.105/432) was published in 1989, and its addendum 1 in 1990; it will be reissued in 1992.

46. Similarly, the directory on "Information Systems on Space Science and Technology" (A/AC.105/397/Rev.1), published in 1988, will be reissued in 1992.

47. Beginning in 1989, a number of papers were selected from those presented at the meetings, workshops and training courses organized under the auspices of the United Nations Programme on Space Applications and were published as a document (A/AC.105/443); this series of papers will be published on a regular basis. This step is being taken in order to provide a wider circulation of ideas and information that can be of significant benefit to Member States as they seek to employ elements of space science and technology in their social and economic development. The publication will be devoted to different aspects of space science and technology, including remote sensing, satellite meteorology, satellite communications and basic space science. It will contain papers that provide information of enduring and broad interest as well as those that focus on problems that are specifically related to issues of interest and concern to the developing countries. Each paper will appear in its language of presentation. The 1990 publication is entitled "Seminars of the United Nations Programme on Space Applications: selected papers on remote sensing technology and satellite communications" (A/AC.105/468).

F. Promotion of greater co-operation in space science and technology

48. The United Nations participated in the twenty-eighth plenary meeting of the Committee on Space Research (COSPAR), held at The Hague, from 25 June to 6 July 1990, and co-sponsored its Session II: Special Panel on "Equatorial Electrojet and Related Phenomena". The Programme provided round-trip air travel and per diem to a participant from Brazil to attend the meeting and its associated activities.

49. Through the Programme, the United Nations co-sponsored, with the International Astronautical Federation (IAF), the special session on "Space and Forest Management" during the forty-first IAF Congress held at Dresden, Germany, from 6 to 13 October 1990. This special session concentrated on the problems of developing countries. Three experts, each from China, Jamaica and Nigeria, whose international air travel was funded by the United Nations, were among those selected by the IAF Bureau for presentation of their papers at the session.

Future activities

50. A United Nations/IAF Workshop on Space Technologies for Development will be held from 3 to 5 October 1991 in conjunction with the International Astronautical Congress scheduled to be held from 7 to 11 October 1991 at Montreal, Canada. The workshop will examine ways in which developing countries can identify specific space technologies and applications that can make a substantial contribution to their priority areas of development at an affordable cost and develop expertise in those technologies and applications. Participants in the workshop will consist of officials from the developing countries who are responsible for, or have an influence on, the science and technology policy of government, academic and research institutions in their own countries.

51. The Programme will co-sponsor a special workshop with COSPAR and IAF during the World Space Congress to be organized by both non-governmental organizations in Washington in August 1992. The Programme will also co-sponsor a special workshop at the seventeenth congress of the International Society for Photogrammetry and Remote Sensing (ISPRS), to be held in Washington in August 1992. Details of these activities are still in the planning stage.

II. VOLUNTARY CONTRIBUTIONS

52. The 1990 activities of the Programme benefited from a variety of support sources and voluntary contributions:

(a) A number of Member States (Austria, Brazil, Canada, China, Cuba, Czechoslovakia, France, Germany, Italy, Norway, Pakistan, Spain, Sweden and the USSR) and the European Space Agency provided support for the activities of the Programme in 1990 in various ways, including the following:

(i) Defrayal of the local expenses of candidates from developing countries in the long-term fellowship programmes (see paras. 4-11 above);

(ii) Voluntary cash contributions in 1990, received from the Governments of Austria ($US 9,000) and Pakistan ($US 12,000);

(iii) Co-sponsorship of the activities of the Programme and, in particular, defrayal of the costs of international air travel, local organization and facilities, room and/or board and local transportation (see paras. 22, 24 and 26);

(iv) Sponsorship (travel and per diem) of experts from Member States to provide technical presentations and to contribute to the deliberations at these activities (see paras. 22, 24, 26 and 32);

(b) FAO contributed $10,000 in support of the United Nations/FAO/ESA Workshop on Microwave Remote Sensing Technology held in São José dos Campos, Brazil; ESA contributed $25,000 to support this same workshop. In addition, FAO, ESA, ITU, UNDRO, INTERSPUTNIK, INMARSAT, INTELSAT and INTERA Technologies (Canada) sponsored the participation of their experts (travel and per diem) in the activities described in paragraphs 24, 26, 28 and 32 above.

III. FINANCIAL PROVISIONS AND ADMINISTRATION OF THE 1991 PROGRAMME ACTIVITIES

53. The 1991 Programme activities described in the present report will be implemented in the following manner:

(a) Financial provisions. Under the United Nations regular budget, an amount of $126,450 was approved by the General Assembly at its forty-fourth session for implementing the 1991 activities of the Programme. Because of insufficient budgetary allocations for the mandated and expanded activities of the Programme, it

has become necessary to solicit additional funds, in the form of voluntary contributions, in support of these activities. Those voluntary contributions, which are deposited into the Space Applications Programme Trust Fund account, will be used to supplement the regular budget of the Programme.

(b) Administration by, and contributions and participation of staff. The Outer Space Affairs Division, and in particular the Expert on Space Applications and his staff, will carry out the activities described in the present report. In this connection, travel would be undertaken as appropriate by the Expert and his staff within the provisions of the biennium travel budget of the Outer Space Affairs Division as approved by the General Assembly at its forty-fourth session and as may be necessary from voluntary contributions.

(c) Consultants, instructors/speakers and technical materials. Up to 15 specialists in space science and technology and its applications would be required to serve as instructors, speakers and consultants during the implementation of the 1991 activities of the Programme. Expenses incurred in respect of the travel and per diem of these specialists and for necessary technical materials would be met partly from the amount specified in paragraph 52 (a) above and partly from voluntary contributions received from Member States and international organizations.

IV. EVALUATION OF THE ACTIVITIES OF THE UNITED NATIONS PROGRAMME ON SPACE APPLICATIONS FOR 1987

54. A candidate from a developing country who has participated in the activities of the Programme would require from one to two years to establish needed facilities and support at the local level before he/she could make a meaningful use of the knowledge gained while participating in the activity of the Programme. Thus, a survey of those who participated in the activities of the Programme in 1987 was carried out in 1990. The evaluation of the effectiveness of the Programme activities described in the present report is based on information received as feedback from those participants; the results of the evaluation are contained in the paragraphs that follow.

55. In 1987, the activities of the Programme included three training courses, held at Dresden, Germany; Jakarta, Indonesia; and Rome, Italy. The courses were devoted to remote sensing applications to geological sciences, operational agrometeorology and hydrology, and marine fisheries. A seminar on space communications was also held in Moscow in the same year. An expert meeting on space science and technology and its applications within the framework of education systems was also held at Lagos in 1987. On 6 April 1990, a questionnaire was sent to the 101 individuals who had participated in the training courses, the seminar and the expert meeting. The statistical evaluation of the responses received is given below.

56. A total of 28 participants, out of the 101 who participated in the activities, responded to the questionnaire. The professional activities of several of the 28 participants have been in more than one area. Four of the respondents continued working in communications, 4 in meteorology, 14 in remote sensing, 4 in mapping,

3 in agriculture, 4 in hydrology, 10 in geology, 2 in mineralogy, 10 in fisheries and 9 in disciplines related to the environment. Their post-meeting overall activities are summarized as follows:

	Number of participants
Research and development	17
Planning	5
Operational activities	12
Education	5

57. The table below gives the number of participants who expressed the view that their participation in the activities had enabled them to initiate, establish, run or direct the following groups, facilities or activities in their different professional fields:

	Initiate	Establish	Run
	(Number of participants)		
Study Group	8	1	4
Co-ordination of user group	2	4	1
National committee	3	1	3
National programme	2	3	4
Regional/international co-operation	4	3	2
Data receiving station	1	2	-
Data analysis centre	3	3	1
Training facility	6	3	4

V. INTERNATIONAL SPACE YEAR 1992: PARTICIPATION OF THE UNITED NATIONS

United Nations guidebook on International Space Year

58. The document entitled "Participation of the United Nations in International Space Year" (A/AC.105/445 and Add.1 and 2) which was reviewed by the Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space and by the Committee itself at their 1990 sessions, has been recast in a new publication entitled "Guide to the Participation of the United Nations in the International Space Year (ISY) - 1992".

General Assembly resolution and Secretary-General's note verbale on United Nations participation in International Space Year

59. The portion of the text of General Assembly resolution 45/72 of 11 December 1990 dealing with United Nations participation in ISY is presented in paragraph 2 of A/AC.105/445/Add.3. On 14 December 1990, the United Nations circulated copies of the above-mentioned guidebook along with the note verbale of the Secretary-General on the participation of the United Nations in ISY to all Member States (see A/AC.105/445/Add.3, para. 3).

Current Status of planned activities to be undertaken by the United Nations as part of International Space Year

60. The status of planned United Nations ISY activities are detailed in paragraphs 5-13 and the annex to document A/AC.105/445/Add.3. This includes the status of the training courses/workshops/conferences, the planned United Nations workshop on "Bridging the Information Gap in Space Science and Technology" with a view to soliciting appropriate space-related scientific publications for institutions in the developing countries, the observation of artificial space objects in 1992 and the publication of a booklet on science centres, or "universariums". The document also contains the current status of the joint United Nations/ESA effort to make available satellite-acquired data for projects in African countries covered by ESA's Maspalomas and Fucino ground receiving stations, the telecast and the preparation of a video series and the exhibit entitled "The Home Planet" which is to be organized at United Nations Headquarters from June to September 1992.

61. The "Home Planet" exhibit should be a balanced and an integrated one and should include the initial as well as the latest images of the Earth acquired from space by Earth-orbiting satellites and manned space voyages, together with products of interplanetary missions in the last three decades up until 1992. Elements of Earth observation programmes that are still in the developmental stage are likely to be reflected in the exhibit.

Annex

LONG-RANGE FELLOWSHIPS OFFERED BY MEMBER STATES AND AN INTERNATIONAL ORGANIZATION WITHIN THE FRAMEWORK OF THE UNITED NATIONS PROGRAMME ON SPACE APPLICATIONS BEGINNING IN 1990-1991 a/

Period	Country/ organization	Subject	Financial support by host country/organization	Offered	Selected	Applied	User countries (one or more candidates selected)
1990-1991	Austria	Telecommunications (microwave technology)	Subsistence allowance; installation grant; local transportation allowance; health and accident insurance	2	2	9	China Syrian Arab Republic
1990	Brazil	Research and applications in remote sensing	Subsistence allowance; medical and accident insurance	10	7	9	Argentina (1) Ecuador (1) Paraguay (2) Peru (3)
1990-1991	China	Geodesy, photogrammetry and remote sensing	Subsistence allowance; medical insurance	2	2	15	Jordan (1) Zaire (1)
1990-1995	Union of Soviet Socialist Republics	Geodesy, cartography and aerial photography	Subsistence allowance; medical insurance; return air travel on successful completion of programme	15	7	12	China (2) Bolivia (3) Mongolia (1) Syrian Arab Republic (1)
1990-1993	Union of Soviet Socialist Republics	Research in remote sensing instrumentation and ecological monitoring	Subsistence allowance; medical insurance	5	-	10	In progress
1990-1993	Union of Soviet Socialist Republics	Research fellowships in basic space sciences	Subsistence allowance; medical insurance; return air travel on successful completion of programme	6	4	19	China (2) Mongolia (2)
1990-1991	European Space Agency	Satellite meteorology	Subsistence allowance	1	1	6	China
1990-1991	European Space Agency	Communications engineering	Subsistence allowance	1	1	6	China
1990-1991	European Space Agency	Remote sensing information systems	Subsistence allowance	1	2 c/	5	Brazil
1990-1991	European Space Agency	Communications systems	Subsistence allowance	1	1	25	China
			TOTAL	44 b/	27 b/	116 b/	

a/ These fellowship awards were made on the basis of: (i) the background and qualifications of nominated candidates; (ii) the evaluation and recommendations of the United Nations; and (iii) the analysis and final decision of the Government/organization/institution awarding the fellowship.

b/ These figures refer to the fellowship programmes processed as of 15 December 1990.

c/ Two participants for a period of six months each.